Appl. No. 09/425,234
Amdt. dated June 3, 2004
Reply to Office Action of February 17, 2004
and Advisory Action of May 5, 2004

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended)   A method for cleaning one or more membranes normally immersed in water containing solids and used to produce a filtered permeate comprising:

(A) first cleanings to increase the permeability of the membranes from time to time; and,

(B) between the first cleanings, performing cleaning events generally periodically at a frequency of at least one or more cleaning events per week, each cleaning event having the steps of:

(a) stopping permeation;

(b) flowing a chemical cleaner through the membranes in a direction opposite to the direction in which permeate normally passes through the membranes to provide chemical cleaner in an area in or adjacent the membranes for a period of time; and,

(c) resuming permeation,

wherein

(i) each of the one or more cleaning events has a CT which is equal to (A) the concentration of the chemical cleaner expressed as an equivalent concentration of NaOCl in cleaning efficacy multiplied by (B) the period of time;

(ii) the one or more cleaning events has a weekly CT which is equal to the sum of the CT's of the one or more cleaning events performed in a week and is between 2,000 minutes•mg/L and 30,000 minutes•mg/L; and,

(iii) the cleaning events reduce the rate of decline in permeability of the membranes between the first cleanings; and,

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(iv) the first cleanings are more intensive than the cleaning events.

2. (Previously Presented) The method of claim 1 wherein the weekly CT is between 2,000 minutes•mg/L and 20,000 minutes•mg/L.

3. (Previously Presented) The method of claim 1 wherein the permeate is intended for drinking water and the weekly CT is between 5,000 minutes•mg/L and 10,000 minutes•mg/L.

4. (Previously Presented) The method of claim 1 wherein the water containing solids is a wastewater and the weekly CT is between 10,000 minutes•mg/L and 30,000 minutes•mg/L.

5. (Currently Amended)   A method of cleaning one or more membranes normally immersed in water containing solids in a tank, the one or more membranes arranged into one or more modules such that permeate sides of the one or more membranes enclose a space in communication with one or more headers of the one or more modules, and used to produce a filtered permeate comprising:

performing cleaning events having the steps of:

(a) stopping permeation;

(b) after step (a), and before resuming permeation, flowing a chemical cleaner to the one or more headers through the membranes, in a direction opposite to the direction in which permeate passes through the membranes, in a series of pulses, wherein the pulses are separated from each other by waiting periods in which the flow of chemical cleaner is stopped;

(c) after step (b), resuming permeation;

wherein

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(d) the membranes remain immersed in the water containing solids while the chemical cleaner flows ~~through the membranes~~to the one or more headers; ~~and,~~

(e) the outside of the membranes is in fluid communication with the water containing solids; and,

(f) during step (b), all chemical cleaner reaching the one or more headers remains in the enclosed space of the one or more modules or flows through the walls of the membranes in a direction opposite to the direction in which permeate normally passes through the walls of the membranes.

6. (Currently Amended)   The method of claim 5 wherein the cleaning events are repeated generally periodically at a frequency between 1 and 7 times per week between more intensive first cleanings performed at least 15 days apart to increase the permeability of the membranes. .

7. (Previously Presented)   The method of claim 6 wherein

(i) each cleaning event has a CT which is equal to (A) the concentration of the chemical cleaner expressed as an equivalent concentration of NaOCl in cleaning efficacy multiplied by (B) the time during which the chemical cleaner remains effective in the area adjacent the membranes; and,

(ii) the cleaning events have a weekly CT which is equal to the sum of the CT's of the one or more cleaning events performed in a week and is between 2,000 minutes•mg/L and 30,000 minutes•mg/L;

8. (Previously Presented)   The method of claim 7 wherein the weekly CT is between 2,000 minutes•mg/L and 20,000 minutes•mg/L.

9. (Previously Presented)   The method of claim 6 wherein the permeate is intended for drinking water and the weekly CT is between 5,000 minutes•mg/L and 10,000 minutes•mg/L.

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10. (Previously Presented) The method of claim 6 wherein the water containing solids is a wastewater and the weekly CT is between 10,000 minutes•mg/L and 30,000 minutes•mg/L.

11. (Previously Presented) The method of claim 5 wherein the pulse steps last for between 10 seconds and 100 seconds and the waiting periods last for between 50 seconds and 6 minutes.

12. (Currently Amended)   The method of claim 5 wherein the pulse steps last for ~~between~~ at least 10 seconds ~~and 100 seconds~~ and the waiting periods last for at least ~~between~~ 50 seconds ~~and 3 minutes~~.

13. (Currently Amended)   The method of claim 5 wherein the length of the pulse steps is selected to provide chemical cleaner in an area in the membranes and in an area in tank water adjacent the outside of~~to~~ the membranes with an initial efficacy and the length of the waiting periods is selected to provide substantially effective chemical cleaner in an area in the membranes and an area in tank water adjacent the outsides of ~~to~~ the membranes during the waiting period.

14. (Previously Presented) The method of claim 5 wherein the membranes are hollow fibre membranes and the pressure of the cleaning chemical in the pulse steps is between 5 kPa and 55 kPa above the pressure on the outside of the membranes.

15. (Previously Presented) The method of claim 14 wherein the flow through the membranes during the pulse steps is between 8.5 and 51 $L/m^2/h$.

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16. (Currently Amended)   The method of claim 5 wherein chemical cleaner is removed from the tank ~~as retentate~~through a drain in the tank before permeation is resumed.

17. (Currently Amended)   The method of claim 16 wherein substantially all of the chemical cleaner is removed from the tank ~~as retentate~~through a drain in the tank before permeation is resumed.

Claims 18-26 (Cancelled)

27. (Previously Presented) A method for cleaning one or more membranes normally immersed in water containing solids and used to produce a filtered permeate comprising:

(A) performing first cleanings to increase the permeability of the membranes from time to time, the first cleanings being at least 15 days apart from each other; and,

(B) between the first cleanings, performing cleaning events at least once a week, the cleaning events each having the steps of:

(a) stopping permeation;

(b) flowing a chemical cleaner through the membranes in a direction opposite to the direction in which permeate normally passes through the membranes to provide chemical cleaner in an area in or adjacent the membranes for a period of time; and,

(c) resuming permeation,
wherein

(i) the chemical cleaner in each cleaning event has a concentration between about 20 mg/L and about 200 mg/L when expressed as an equivalent concentration of NaOCl in cleaning efficacy;

(ii) the period of time of each cleaning event is between about 10 minutes and about 100 minutes;

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(iii) each of the one or more cleaning events has a CT which is equal to (A) the concentration of the chemical cleaner expressed as an equivalent concentration of NaOCl in cleaning efficacy multiplied by (B) the period of time; and,

(iv) the sum of the CT's of the one or more cleaning events performed in a week is between 2,000 minutes•mg/L and 30,000 minutes•mg/L.

28. (Previously Presented) The method of claim 27 wherein the sum of the weekly CT is between 2,000 minutes•mg/L and 20,000 minutes•mg/L.

29. (Previously Presented) The method of claim 27 wherein the permeate is intended for drinking water and the weekly CT is between 5,000 minutes•mg/L and 10,000 minutes•mg/L.

30. (Previously Presented) The method of claim 27 wherein the water containing solids is a wastewater and the weekly CT is between 10,000 minutes•mg/L and 30,000 minutes•mg/L.

31. (Previously Presented) The method of any of claims 27 through 30 wherein

(a) the membranes remain immersed in the water containing solids while the chemical cleaner flows through the membranes;

(b) the outside of the membranes is in fluid communication with the water containing solids; and,

(c) the membranes are not agitated while the chemical cleaner is flowed through the membranes.

32. (Previously Presented) The method of claim 1 wherein the first cleanings are at least 15 days apart.

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33. (Previously Presented) The method of claim 27 wherein the decrease in the permeability of the membranes between performances of step (B) is at least as great as any increase in the permeability of the membranes after a performance of step (B).

34. (Previously Presented) The method of claim 1 wherein the membranes are hollow fibre membranes.

35. (Previously Presented) The method of claim 1 wherein the membranes are immersed in the water in an open tank and are not agitated during step (B)(b) of claim 1.

36. (Previously Presented) The method of claim 1 wherein the step of flowing a chemical cleaner through the membranes further comprises the step of flowing water to the permeate sides of the membranes and introducing a chemical cleaner to the flowing water.

37. (Previously Presented) The method of claim 1 wherein the cleaning events are performed at regular intervals and each have about the same CT.

38. (Currently Amended) The method of claim 1 wherein some or all of the water in the tank before step (B)(b) of claim 1 is replaced with feed water after between step (B)(b) and step B(c) of claim 1.